RWS-150082

Revision of RWS-150035

Update on ITU-R Work on IMT-2020 for 5G

3GPP RAN Workshop on 5G (17-18 September 2015)

Stephen Blust
Chairman, ITU-R Working Party 5D
AT&T, Inc

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(V4.2 9-14-15)

Update on ITU-R Work on IMT-2020 for 5G

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Update on ITU-R Work on IMT-2020 for 5G

Executive Summary

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5G Related Aspects in ITU-R Working Party 5D
(Responsible group for terrestrial IMT in ITU-R)

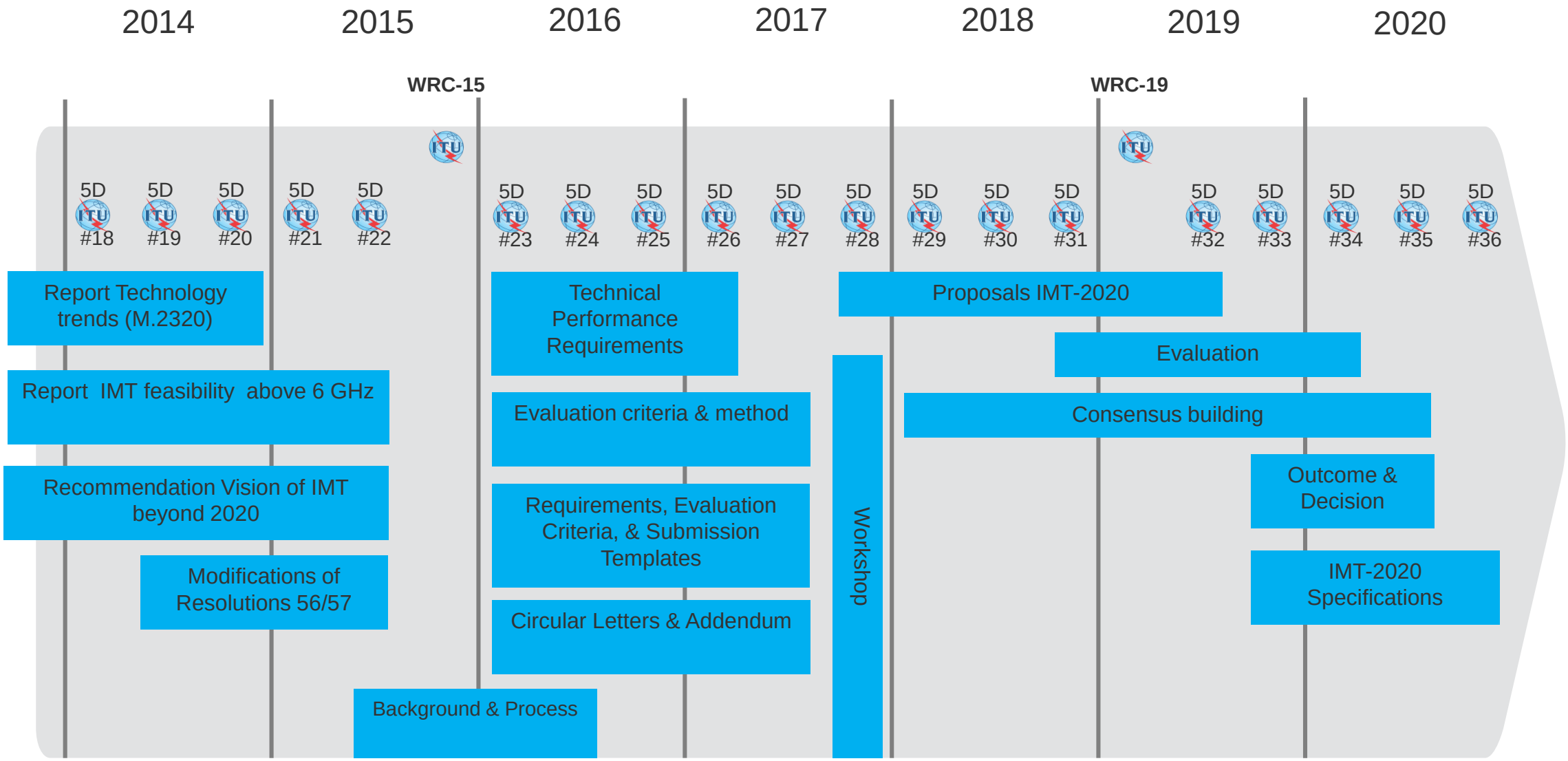
Work towards IMT-2020 was initiated in 2012 with 'foundation' deliverables completed over the period from 2013 through 2015.

Work on the next phases of IMT-2020 will ramp up in 2016 and early aspects on the work have been initiated towards the radio interface technology or sets of radio interface technologies

- The Report on the **Technical Performance Requirements** that a technology would need to meet to satisfy "IMT-2020"
- The Report on **Evaluation Criteria and Evaluation Methods** for "IMT-2020" technologies
- The **Report on Specific Submission Requirements** of the candidate technology under assessment related to submissions, the evaluation criteria and submission templates
- **Communication via Circular Letters and Liaisons** will be a key element of the work.

Detailed Timeline & Process For IMT-2020 in ITU-R

NOTE: THIS TIMELINE IS THE CURRENT VIEW PUBLISHED BY ITU-R WP 5D AND BEING UTILIZED BY ITU-R & INDUSTRY



Note: While not expected to change, details may be adjusted if warranted.

Key Themes on the Timeline & Plan for "IMT-2020"

- Working Party 5D will use a similar process and deliverable format used in the development of IMT-Advanced.

- Coordination with entities external to ITU-R will continue to be a cornerstone in the work.

- *In the 2016-2017 time-frame, WP 5D will define in detail the performance requirements and evaluation criteria and methodology for the assessment of new IMT terrestrial radio interface.*

- It is anticipated that the timeframe for proposals will be focused at 2018 (window spans late 2017 to mid-2019).

- The evaluation by independent external evaluation groups and definition of the new radio interfaces to be included in "IMT-2020" will take place from 2018-2020.

Important “Technology Proponent Organizations” Milestones on IMT-2020

- It is expected that **the final specifications for the “global core specification (GCS)” from the external organizations** (the technology proponents) towards the work on Draft new Recommendation ITU-R M.[IMT-2020.SPECS] *“Detailed specifications of the terrestrial radio interfaces of “IMT-2020”* **would be received into WP 5D Meeting #34 (February 2020) at the latest.**

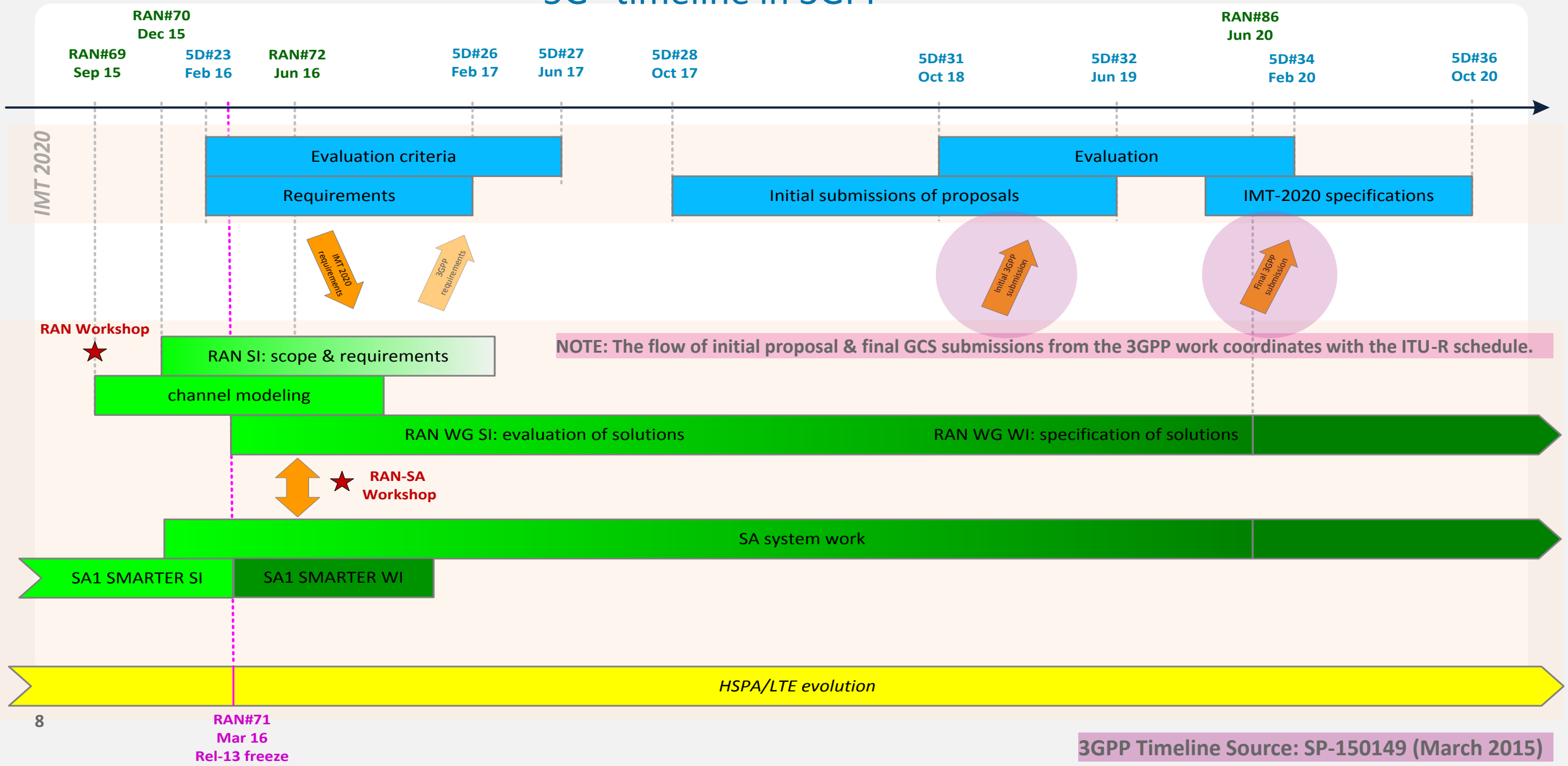
- **Transposed specifications** (from the individual regional or national transposing organizations) would be **received at WP 5D Meeting #35 (June 2020)** at the latest.

- The finalization of the complete Draft New Recommendation ITU-R M.[IMT-2020.SPECS] for the initial release of “IMT-2020” would be at WP 5D Meeting #36 (October 2020).

Example of Coordination on the Schedules & Work: *Integrated 3GPP View of 3GPP Work & ITU-R*

NOTE: THIS HIGH LEVEL TIMELINE IS THE INITIAL VIEW PUBLISHED BY 3GPP – RELEASE 14-17 TIMINGS & SPECIFIC WORK SCOPE NOT YET ESTABLISHED

"5G" timeline in 3GPP



3GPP Timeline Source: SP-150149 (March 2015)

Requirements Development

- 5G may be different because of the wide range of use cases creating distinctly different “wants” and potentially separate sets of requirement values
  - IoT
  - “Typical” Wireless Broadband
  - Video and other higher bandwidth applications (e.g, above 6 GHz)
- An ITU Circular Letter, formally (call for inputs) will be initiated at ITU-R WP 5D #23 in February 2016 and will also announce the process.
- Liaisons from WP 5D to External Organizations will solicit information
- A consensus driven process will set the actual values, or range of values
- The resulting Key Characteristics and their values will be merged in to an ITU Report

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5D Requirements Anticipated Work Plan

WP 5D #23, February 2016:
- Liaison to external organizations requesting key parameter names and definitions
- Discussion of requirements document structure

WP 5D #24, June 2016:
- Receive liaison replies and agree on key parameter names and definitions
- Inform the Evaluation SWG on the agreed key parameter names and definitions
- Liaison to external organizations requesting target values for each requirement

WP 5D #25, October 2016:
- Receive liaison replies and start discussion of technical requirement values
- Update work plan and assign ad-hoc meetings if necessary to complete by WP 5D #27

WP 5D #26, February 2017:
- Finalize requirements and approve report in WP 5D
- Send completed requirements to the Evaluation SWG

SG5, [November 2017]:
- Approve requirements report in SG5

Note: This work plan was an initial view from 22nd meeting. It will be reviewed at the 23rd meeting and may be updated before confirming.

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“IMT-2020” Standardization Process – Where we are and what is ahead

2012-2015	2016-2017	2018-2019	2019-2020
❖ Development Plan ❖ Market/Services View ❖ Technology/ Research Kick Off ❖ Vision & Framework ❖ Name IMT-2020 ❖ < 6 GHz Spectrum View ❖ > 6 GHz Technical View ❖ Process Optimization	❖ Spectrum/Band Arrangements (post WRC-15) ❖ Technical Performance Requirements ❖ Evaluation Criteria ❖ Invitation for Proposals ❖ Sharing Study Parameters (IMT-WRC-19) ❖ Sharing Studies (WRC-19)	❖ Proposals ❖ Evaluation ❖ Consensus Building ❖ CPM Report (IMT-WRC-19) ❖ Sharing Study Reports (WRC-19)	❖ Spectrum/Band Arrangements (WRC-19 related) ❖ Decision & Radio Framework ❖ Detailed IMT-2020 Radio Interface Specifications ❖ Future Enhancement/ Update Plan & Process

Setting the stage for the future: vision, spectrum, and technology views

Defining the technology

Synopsis

- Working Party 5D has developed an overarching and coordinated plan
- Continues the Partnership with industry as the success model for 5G
- Much foundation work has already been completed
- A lot of work is still required
- Next steps are to define the radio interface technology minimum performance requirements and evaluation details
  - 5G requirements will come from many different sources
  - More complex paradigm for development of requirements
  - Requirements provide a technical baseline for industry
  - Aggressive timeline

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Update on ITU-R Work on IMT-2020 for 5G

Current Status & Next Steps

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5G Related Aspects in ITU-R Working Party 5D

(Responsible group for terrestrial IMT in ITU-R)

WP 5D initiated detailed work in 2012 towards the next generation IMT for the year 2020 and beyond (i.e., "5G").

- Agreement on a work plan through year 2020 to address constituent parts of "5G" as parts of "IMT for 2020"
- Foundation work now such as technology perspectives and future vision and the more detailed defining information in near future
- Supported the need for additional spectrum for the future success of IMT for WRC-15 and stage setting for WRC-19
- ***Released a detailed time line and action plan for IMT for 2020 to energize and focus the industry "5G" activities through year 2020***
- ***Released a detailed deliverables table on the mapping of the work by meeting of WP 5D through year 2020***
- ***ITU-R Recommendations & Reports in the initial "foundation" set of deliverables were completed in 2014 and 2015***

5G Related Aspects in ITU-R Working Party 5D

The work on the next phases of IMT-2020 will ramp up in 2016 and early aspects have been initiated towards the radio interface technology or sets of radio interface technologies

- The Report on the **Technical Performance Requirements** expected that a technology would need to meet to satisfy "IMT-2020"
- The Report on **Evaluation Criteria and Evaluation Methods** for "IMT-2020" technologies
- The Report on Specific Requirements of the candidate technology related to submissions, the evaluation criteria and submission templates
- For efficiency, the process and deliverable formats that were effectively utilized for IMT-Advanced will be leveraged

Detailed Timeline & Process For IMT-2020 in ITU-R

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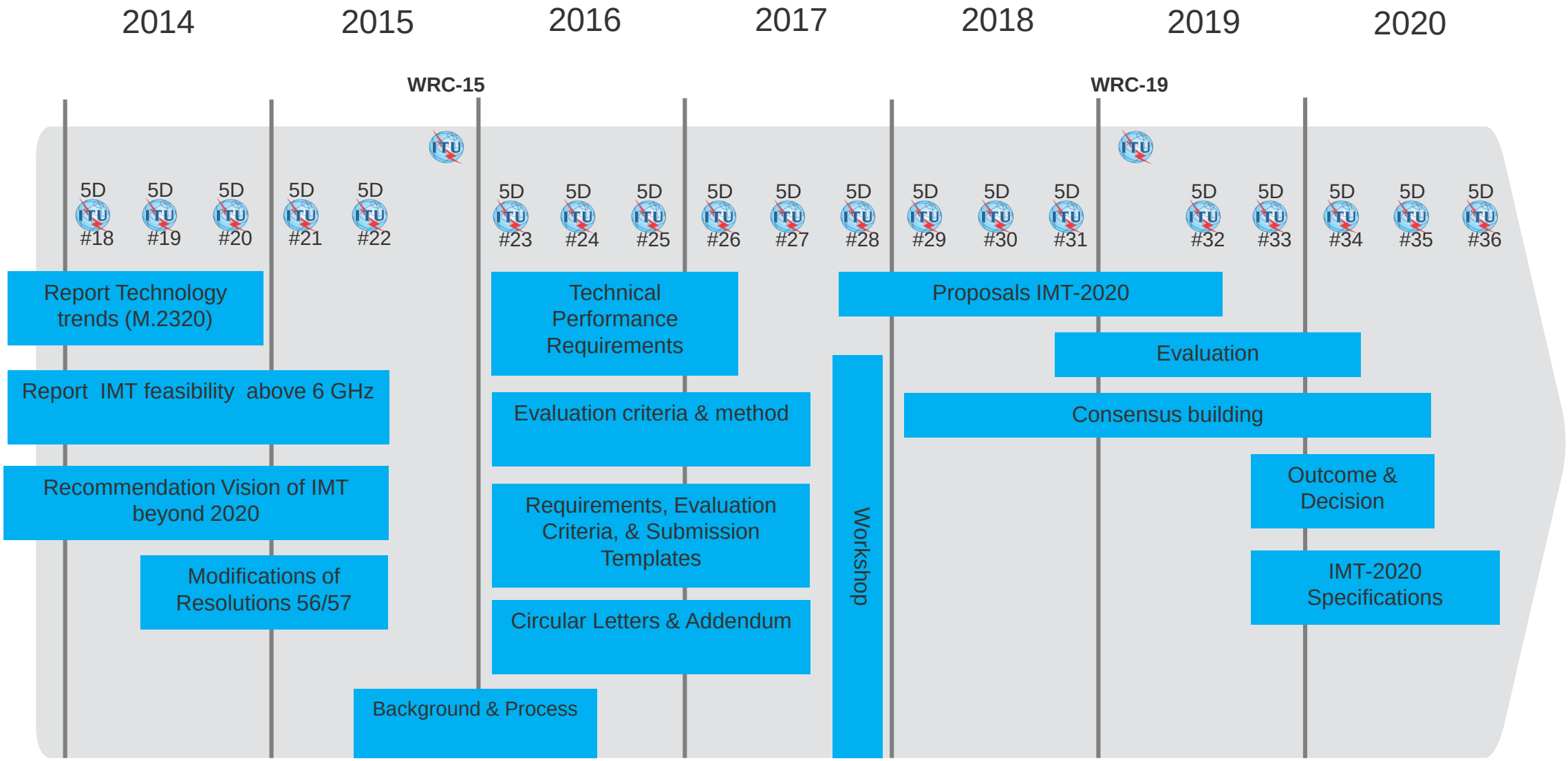

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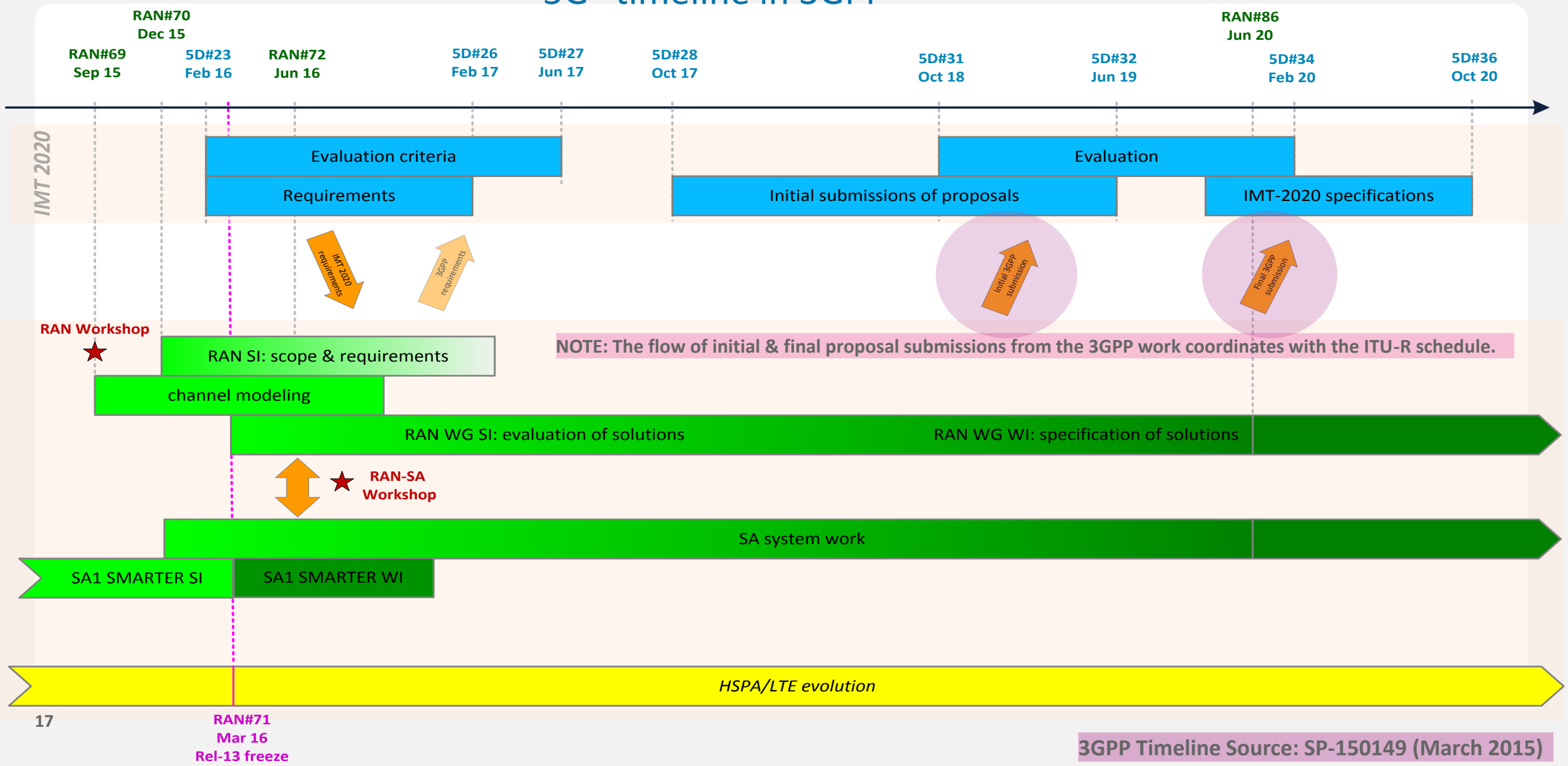

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Setting the stage for the future: vision, spectrum, and technology views

Defining the technology

Key Themes on the Timeline & Plan for "IMT-2020"

- Working Party 5D will essentially use the same process and deliverable formats successfully utilized in the development of IMT-Advanced.
- *In the next phase, in the 2016-2017 time-frame, WP 5D will define in detail the performance requirements and evaluation criteria and methodology for the assessment of new IMT terrestrial radio interface.*
- It is anticipated that the timeframe for proposals will be focused in 2018 (window spans late 2017 to mid-2019).
- In 2018-2020 the evaluation by independent external evaluation groups and definition of the new radio interfaces to be included in "IMT-2020" will take place.

Key Themes on the Timeline & Plan for "IMT-2020"

- Working Party 5D plans to hold a workshop in late 2017 that will allow for an explanation and discussion on performance requirements and evaluation criteria and methodology for candidate technologies for "IMT-2020" that has been developed by WP 5D, as well as to provide an opportunity for presentations by potential proponents for "IMT-2020" in an informal setting.

- The whole process for the initial release of "IMT-2020" is planned to be completed in 2020 when a draft new ITU-R Recommendation with detailed specifications for the new terrestrial radio interfaces of "IMT-2020" will be submitted for approval within ITU-R.

- Enhancement and additional capabilities for "IMT-2020" are expected to start in 2021 and be on-going.

Important "Technology Proponent Organizations" Milestones on IMT-2020

- Is expected that the final specifications for the "global core specification" from the external organizations (the technology proponents) towards the work on Draft new Recommendation ITU-R M.[IMT-2020.SPECS] *"Detailed specifications of the terrestrial radio interfaces of "IMT-2020"* would be received into WP 5D Meeting #34 (February 2020) at the latest.

- Transposed specifications (from the individual regional or national transposing organizations) would be received at WP 5D Meeting #35 (June 2020) at the latest.

- The finalization of the complete Draft New Recommendation ITU-R M.[IMT-2020.SPECS] for the initial release of "IMT-2020" would be at WP 5D Meeting #36.

- Details of specific requests for material from the external organizations and relevant timings of the process steps will be communicated through ITU-R Circular Letters and liaisons and is expected to be similar to the process in Docs ITU-R IMT- ADV/24 Rev 2.

Update on ITU-R Work on IMT-2020 for 5G

Developing the Minimum Performance Requirements

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Requirements Development-1

5G may be different than previous efforts because of the wide range of use cases which creating distinctly different “wants” and ultimately separate sets of requirement values

- IoT
- “Typical” Wireless Broadband
- Video and other higher bandwidth applications

From an ITU perspective, a Circular Letter, (call for inputs) will be initiated at ITU-R WP 5D #23 in February 2016

- This CL will focus on formally announcing the process and the immediate next steps

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Requirements Development-2

Liaisons from WP 5D to External Organizations will solicit information seeking:

- Understanding of the key characteristics to define the overall detailed requirement universe and subsequently the detailed information necessary to establish the actual parameter values

A consensus driven process will set the actual values, or range of values

- As noted above, there may be more than one set of value

The resulting Key Characteristics and their values will be merged in to an ITU Report

- These values will be used as part of the evaluation criteria
- Evaluation methodology and environments must be taken into account in the development of the requirements to ensure consistency

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Representative List of Outreach of WP 5D to External Entities Engaged in 5G Developments

3GPP,

3GPP2,

4G Americas,

5G Infrastructure Public Private Partnership (Europe),

5G Innovation Centre,

APT Wireless Group,

Fifth Generation Mobile Communications Promotion Forum (Japan),

ARIB, ATIS,

CCSA,

CDG,

ETSI, EU METIS Project,

GSMA,

IEEE,

IMT-2020 Promotion Group (China),

ITRI,

NGMN,

NYU Wireless,

Telecommunications Standards Development Society (India),

TIA,

TTA,

TTC,

UMTS Forum,

WiMax Forum, Wireless

World Research Forum

We welcome any other interested partners

Requirements Overview

The IMT-2020 [5G] requirements provide the industry with a technical baseline

Examples (not exhaustive) of some minimum requirements could be:

- Spectral efficiency
- Bandwidth
- Throughput; Peak & User Data Rates
- Mobility
- Latency
- Capacity
- Support of IoT
- QoS
- Energy Efficiency
- And other factors such as:
  - Test Environments (e.g., indoor, microcellular, base coverage urban, high speed…)
  - Representative Frequency Bands

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5G Capability Perspectives from the ITU-R IMT-2020 Vision Recommendation

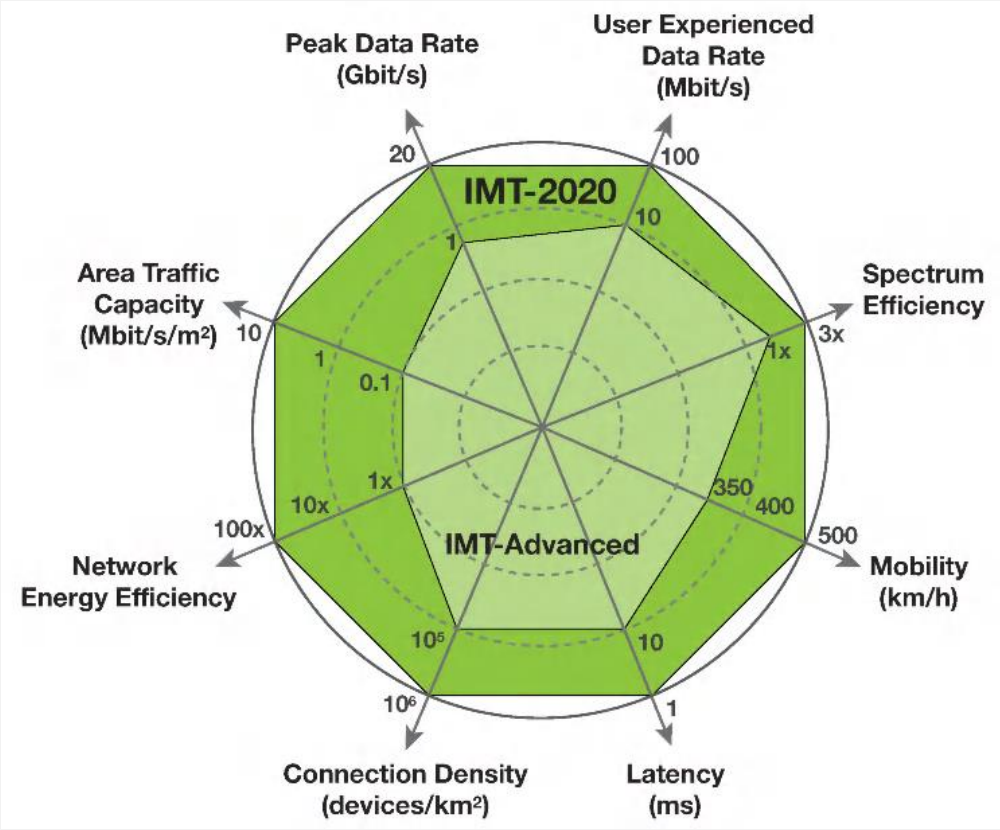

Fig 3. Enhancement of key capabilities from IMT-Advanced to IMT-2020

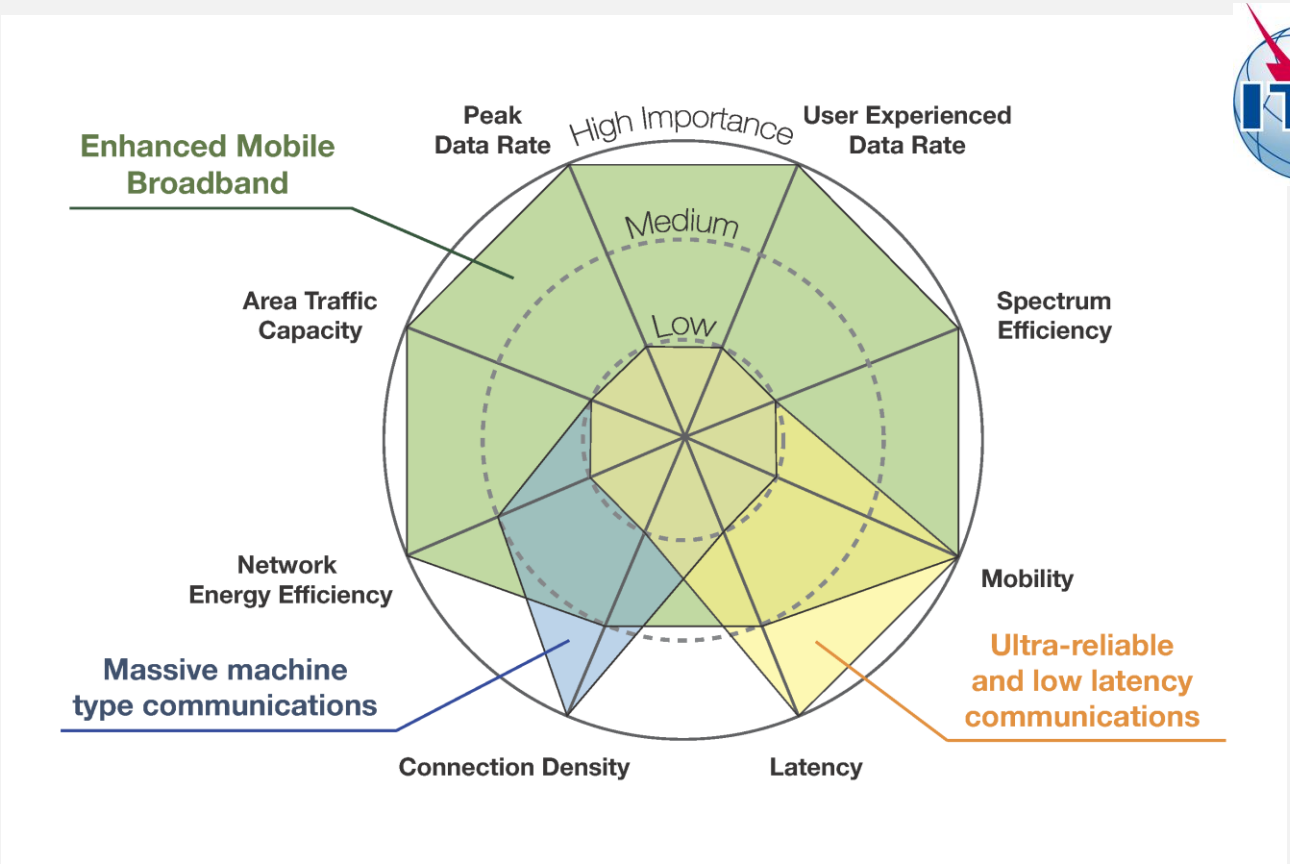

Fig 4. The importance of key capabilities in different usage scenarios

The values in the Figure 3 above are targets for research and investigation for IMT-2020 and may be further developed in other ITU-R Recommendations, and may be revised in the light of future studies..

Additional descriptions and further details for both Figure are in the IMT-2020 Vision Recommendation

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Methodology of Requirements Gathering in WP 5D

- **Requests for requirement parameter *names and definitions (key characteristics)* at WP 5D #23 (February 2016)**
  - Inputs requested from ITU-R Members
  - Initial liaison statement is sent to "External Organizations" (SDOs, research organizations, and other identified recipients)
- **Key characteristics are received and consensus list is decided at WP 5D #24 (June 2016). Requests initiated for *actual values or ranges of values* for the key characteristics.**
  - Inputs requested from ITU-R Members
  - Another liaison is sent out to External Organizations this time
- **Initial set of parameter values received at WP 5D #25 (October 2016).**
  - These values will be discussed and questions, if any, will be directed back to the External Organizations for clarification (to be received at WP 5D #26, February 2016)
- **At WP 5D #26, February 2016, the requirements will be finalized and passed to the Evaluation Group in WP 5D for inclusion in the Evaluation Criteria request to External Organizations**

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Additional Information

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2015 Key Deliverables completed and approved in ITU-R

- *Revision of Resolution ITU R 56-1 -*Naming for International Mobile Telecommunications*
- *New Resolution ITU-R [IMT.PRINCIPLES] - *Principles for the process of future development of IMT for 2020 and beyond*
- **Recommendation ITU-R M.[IMT VISION] - *Framework and overall objectives of the future development of IMT for 2020 and beyond*
- **Revision of Recommendation ITU-R M.2012-1 - *Detailed specifications of the terrestrial radio interfaces of (IMT-Advanced)*
- Report ITU-R M.2370- *IMT Traffic estimates beyond year 2020*
- Report ITU-R M.2373- *Interactive unicast and multicast audio-visual capabilities and applications provided over terrestrial IMT systems*
- Report ITU-R M.2376- *The technical feasibility of IMT in the bands above 6 GHz*
- Report ITU-R M.2375- *Architecture and topology of IMT networks*

* Note: Confirmation/approval expected at ITU-R Radio Communication Assembly (26-30 Oct 2015)

** Note: In final stage of approval by ITU-R Member States (23 Sept 2015)

2014 Key Deliverables completed and approved in ITU-R

- *Recommendation ITU-R M.2070 - Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-Advanced.*

- *Recommendation ITU-R M.2071 - Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-Advanced.*

- *Recommendation ITU-R M.1579-2 - Global circulation of IMT terrestrial terminals - Question ITU-R 229-3/5.*

- *Recommendation ITU-R M.1457-12 - Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000).*

- *Report ITU-R M.2039-3 - Characteristics of terrestrial IMT-2000 systems for frequency sharing/interference analyses.*

- *Report ITU-R M.2320 - Future technology trends of terrestrial IMT systems.*

- *Report ITU-R M.2334 - Passive and active antenna systems for base stations of IMT systems.*

2013 Key Deliverables completed and approved that support WRC-15

- Recommendation ITU R M.1768-1 - Methodology for calculation of spectrum requirements for the terrestrial component of International Mobile Telecommunications

- Report ITU-R M.2289 - Future radio aspect parameters for use with the terrestrial IMT spectrum estimate methodology of Recommendation ITU-R M.1768-1

- Report ITU-R M.2290 - Future spectrum requirements estimate for terrestrial IMT

- Report ITU-R M.2291 - The use of International Mobile Telecommunications (IMT) for broadband public protection and disaster relief (PPDR) applications

- Report ITU-R M.2292 - Characteristics of terrestrial IMT-Advanced systems for frequency sharing/interference analyses

WP 5D deliverables initiated in 2015 to complete in 2016

Item	Proposed "IMT-2020" Related Deliverable	Aspect to be Addressed in Proposed Deliverable	Potential Work Start Timing	Potential Document Completion in WP 5D	IMT-Advanced Model Document
1	**Doc. IMT-2020/001 IMT-2020Background"**	Background on IMT-2020	Meeting #22 (June 2015)	Meeting #24 (June 2016)	Document IMT-ADV/1 *"Background on IMT-Advanced"*
2	**Doc. IMT-2020/002 IMT-2020 Process"**	The Submission and evaluation process and consensus building for IMT-2020 as well as the "timeline" for IMT-2020	Meeting #22 (June 2015)	Meeting #24 (June 2016)	Document IMT-ADV/2 *"Submission and evaluation process and consensus building"*

WP 5D deliverables initiated in 2016 to complete in 2017

Item	Proposed "IMT-2020" Related Deliverable	Aspect to be Addressed in Proposed Deliverable	Potential Work Start Timing	Potential Document Completion in WP 5D	IMT-Advanced Model Document
3	**Draft new Report ITU-R M.[IMT-2020. TECH PERF REQ]**	General Technical Performance Requirements expected of a technology to satisfy IMT-2020	Meeting #23 (February 2016)	Meeting #26 (February 2017)	Report ITU-R M.2134 *"Requirements related to technical performance for IMT-Advanced radio interface(s)"*
4	**Draft new Report ITU-R M.[IMT-2020. EVAL]**	Evaluation Criteria and Evaluation Methods for IMT-2020 technologies	Meeting #23 (February 2016)	Meeting #27 (June 2017)	Report ITU-R M.2135 *"Guidelines for evaluation of radio interface technologies for IMT-Advanced"*
5	**Draft new Report ITU-R M.[IMT-2020. SUBMISSION]**	Specific Requirements of the candidate technology related to submissions, the evaluation criteria and submission templates	Meeting #23 (February 2016	Meeting #27 (June 2017)	Report ITU-R M.2133 *"Requirements, evaluation criteria and submission templates for the development of IMT-Advanced"*
6	**Circular Letter IMT-2020**	The official ITU-R announcement of the IMT-2020 process and the invitation for candidate technology submissions	Meeting #23 (February 2016)	Meeting #27 (June 2017)	Circular Letter 5/LCCE/2 and Addenda *"Invitation for submission of proposals for candidate radio interface technologies for the terrestrial components of the radio interface(s) for IMT-Advanced and invitation to participate in their subsequent evaluation"*

New WP 5D deliverables initiated in 2017 to complete in 2019

Item	Proposed "IMT-2020" Related Deliverable	Aspect to be Addressed in Proposed Deliverable	Potential Work Start Timing	Potential Document Completion in WP 5D	IMT-Advanced Model Document
7	**Doc. IMT-2020/YYY Input Submissions Summary**	Capturing in ITU-R documentation the inputs documents and the initial view of suitability as a valid submission	Meeting #28 (October 2017)	Meeting #32 (June 2019)	For example, Documents IMT-ADV/4 thru IMT-ADV/9 "*Acknowledgement of candidate submission from ……under step 3 of the IMT-Advanced process (….. technology)*"

NEW WP 5D deliverables initiated in 2018 to complete in 2020

Item	Proposed "IMT-2020" Related Deliverable	Aspect to be Addressed in Proposed Deliverable	Potential Work Start Timing	Potential Document Completion in WP 5D	IMT-Advanced **Model Document**
8	**Doc. IMT-2020/ZZZ Evaluation Reports Summary**	As the evaluation of each candidate technology proceeds the results of each evaluation of each technology by the different evaluation groups must be documented and analyzed by WP 5D towards the final evaluation assessment	Meeting #31 (October 2018)	Meeting #34 (February 2020)	For example, Documents IMT-ADV/10 thru IMT-ADV/23 *"Evaluation IMT-Advanced candidate technology submissions in documents IMT-ADV/xyz by XYZ Evaluation Group"*

New WP 5D deliverables initiated in 2019 to complete in 2020

Item	Proposed "IMT-2020" Related Deliverable	Aspect to be Addressed in Proposed Deliverable	Potential Work Start Timing	Potential Document Completion in WP 5D	IMT-Advanced Model Document
9	**Draft new Report ITU-R M.[IMT-2020. OUTCOME]**	The outcome of the evaluation and assessment and the statement on those candidate technologies suitable to move to the specification phase in ITU-R	Meeting #33 (October 2019)	Meeting #35 (June 2020)	Report ITU-R M.2198 *"The outcome of the evaluation, consensus building and decision of the IMT-Advanced process (Steps 4 to 7), including characteristics of IMT-Advanced radio interface"*
10	**Draft new Recommendation ITU-R M.[IMT-2020.SPECS]**	The detailed specification of each of IMT-2020 technology	Meeting #33 (October 2019)	Meeting #36 (October 2020)	Recommendation ITU-R M.2012 *"Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-Advanced (IMT-Advanced)"*

WP 5D *Planned* Meeting Schedule Up to 2020

WP 5D	#23	23 February 16	2 March 16	7 working day meeting
WP 5D	#24	14 June 16	22 June 16	7 working day meeting
WP 5D	#25	4 October 16	12 October	7 working day meeting
WP 5D	#26	14 February 17	22 February 17	7 working day meeting
WP 5D	#27	13 June 17	21 June 17	7 working day meeting
WP 5D	#28	3 October 17	11 October 17	7 working day meeting
WP 5D	#29	31 January 18	7 February 18	
WP 5D	#30	13 June 18	20 June 18	
WP 5D	#31	3 October 18	10 October 18	
WRC-19 expected during the first half of 2019				
WP 5D	#32	9 July 19	17 July 19	7 working day meeting
WP 5D	#33	29 October 19	6 November 19	7 working day meeting
WP 5D	#34	19 February 20	26 February 20	
WP 5D	#35	24 June 20	1 July 20	
WP 5D	#36	7 October 20	14 October 20	

Some adjustment of these dates might be required to accommodate availability of facilities at specific venues.
Every effort will be made to keep these dates as listed. Please check the ITU website in case meeting details have changed (http://www.itu.int/events/monthlyagenda.asp?lang=en).

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Thank you

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